

ELECTRONIC TUBE REFERENCE

12SK7

Voltage - Pentode Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Variable-mu pentode designed for AVC-controlled RF and IF amplification with broad gain reduction and reduced cross-modulation.

GENERAL CHARACTERISTICS

BASE DESIGNATION	8N	BASE PINS	8
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

8N - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – SH	A	SH – Internal Shield	CONNECTED
PIN2 – H	–	H – Heater	CONNECTED
PIN3 – G3	A	G3 – Suppressor Grid	CONNECTED
PIN4 – G1	A	G1 – Control Grid	CONNECTED
PIN5 – K	A	K – Cathode	CONNECTED
PIN6 – G2	A	G2 – Screen Grid	CONNECTED
PIN7 – H	–	H – Heater	CONNECTED
PIN8 – P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	800000 Ω
TRANSCONDUCTANCE	0.002 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	4 W
MAXIMUM SCREEN DISSIPATION	0.11 W
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER.</i>	

12SK7 — Remote-Cutoff RF Pentode

An indirectly heated, triple-grid variable-mu pentode designed for radio-frequency and intermediate-frequency amplification with automatic volume control, offering minimized cross-modulation.

Overview

The **12SK7** (along with its glass-envelope variants [12SK7GT](#) and [12SK7GT/G](#)) is a remote-cutoff (variable-mu) pentode designed primarily for use as a radio-frequency (RF) and intermediate-frequency (IF) amplifier. Its design incorporates three grids—a control grid, a screen grid, and a suppressor grid—to achieve stable high-gain amplification while minimizing cross-modulation. The tube is specifically optimized for circuits employing automatic volume control (AVC), where the gain of the stage must be smoothly varied over a wide range of signal levels.

The 12SK7 features an indirectly heated, coated unipotential cathode and is designed to operate from a nominal **12.6 V** heater supply. With the exception of its heater ratings, the electrical characteristics and maximum ratings of the 12SK7 family are identical to those of the [6SK7](#) and [6SK7GT](#) series.

Construction, Physical Dimensions, and Base Pinout

The 12SK7 is manufactured in both metal-shell and glass-bulb configurations, allowing flexibility in physical installation and shielding requirements:

- **12SK7 (Metal Shell):** Housed in an MT8 or MT8G-1 metal envelope with a maximum overall height of 2-5/8 inches, a maximum seated height of 2-5/16 inches, and a maximum diameter of 1-5/16 inches.
- **[12SK7GT](#) / [12SK7GT/G](#) (Glass Bulb):** Housed in a T-9 glass envelope with a maximum overall height of 3-5/16 inches, a maximum seated height of 2-3/4 inches (or 2-11/16 inches depending on the specific variant), and a maximum diameter of 1-5/16 inches.

Both versions utilize a small wafer 8-pin octal base (basing designation **8N**) and can be mounted in **any position**. The pin connections, viewed from the bottom of the base, are assigned as follows:

Pin	Electrode Connection
Pin 1	Shield (S) / Metal Shell
Pin 2	Heater (H)
Pin 3	Suppressor Grid (G3 / Su)
Pin 4	Control Grid (G1)
Pin 5	Cathode (K / C)
Pin 6	Screen Grid (<u>G2</u> / Gs)
Pin 7	Heater (H)
Pin 8	Plate (P / A)

In typical applications, the suppressor grid (Pin 3) is connected directly to the cathode (Pin 5) at the socket.

Heater Characteristics

The heater is designed for either AC or DC operation. The calculated heater power is **1.89 W**, derived from the nominal heater voltage of 12.6 V and the nominal heater current of 0.15 A ($12.6\text{ V} \times 0.15\text{ A} = 1.89\text{ W}$).

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.15 A
Calculated Heater Power	1.89 W
Supply Type	AC or DC
Cathode Type	Coated unipotential

Electrical Characteristics and Typical Operating Points

The 12SK7 is characterized by its remote-cutoff control grid, which allows the transconductance to be varied smoothly over a wide range of negative grid bias voltages. Typical Class A1 amplifier operating points are documented at two distinct plate voltages:

Parameter	Low-Voltage Point	Standard-Voltage Point
Plate (Anode) Voltage	100 V	250 V
Screen (Grid #2) Voltage	100 V	100 V

Parameter	Low-Voltage Point	Standard-Voltage Point
Control Grid (Grid #1) Voltage	-1 V	-3 V
Cathode Bias Resistor	—	220 Ω
Suppressor Grid (Grid #3)	Connected to cathode	Connected to cathode
Plate Current	13 mA to 15 mA	9.2 mA
Screen Current	4.0 mA	2.4 mA to 2.6 mA
Plate Resistance (Anode Impedance)	0.12 M Ω	0.8 M Ω
Transconductance (Mutual Conductance)	2,350 μ mhos	2,000 μ mhos (2.0 mA/V)
Control Grid Voltage for $G_m = 10 \mu$ mhos	-35 V	-35 V

At the standard operating point of 250 V on the plate and 100 V on the screen, a negative control grid bias of -3 V yields a transconductance of 2,000 μ mhos and a high plate resistance of 0.8 Megohm. When the control grid bias is increased to -35 V, the transconductance is reduced to approximately 10 μ mhos (0.01 mA/V), demonstrating the remote-cutoff characteristic.

Maximum Ratings

The maximum ratings for the 12SK7 family, interpreted according to the RMA Standard M8-210, establish the safe operating boundaries for the device:

Rating Parameter	Limit Value
Maximum Plate Voltage	300 V
Maximum Screen (Grid #2) Supply Voltage	300 V
Maximum Screen (Grid #2) Voltage	125 V to 150 V
Maximum Heater-Cathode Voltage	90 V
Minimum External Control Grid Bias Voltage	0 V
Maximum Plate Dissipation	4.0 W
Maximum Screen (Grid #2) Dissipation	0.4 W

Direct Interelectrode Capacitances

The interelectrode capacitances of the 12SK7 differ slightly between the metal-shell and glass-bulb versions. These values are measured with the shell (for the metal tube) or an external shield (for the glass tube) connected directly to the cathode:

Capacitance Parameter	12SK7 (Metal Shell)	<u>12SK7GT</u> / <u>12SK7GT/G</u> (Glass)
Control Grid to Cathode (Input)	6.0 μF	6.5 μF
Plate to Cathode (Output)	7.0 μF	7.5 μF
Control Grid to Plate (Maximum)	0.003 μF	0.005 μF

The extremely low grid-to-plate capacitance (0.003 to 0.005 μF maximum) is a critical design feature of this RF pentode, preventing unwanted feedback and self-oscillation in high-gain RF and IF amplifier stages.

Characteristic Curves and Variable-Mu Behavior

The published characteristic curves for the 12SK7 family illustrate the electrical behavior of the tube under varying voltage conditions:

- **Plate Current vs. Plate Voltage (I_b vs. E_b):** The family of curves plotted for a screen voltage (E_{c2}) of 100 V and suppressor grid (E_{c3} (/tubes/C3)) at 0 V shows typical pentode characteristics. Above a plate voltage of approximately 50 V, the plate current curves flatten out, indicating very high plate resistance. The spacing of the curves for different control grid voltages (E_{c1} (/tubes/C1)) from 0 V down to -15 V shows a gradual compression, which is characteristic of a remote-cutoff grid structure.
- **Transconductance and Currents vs. Control Grid Voltage (g_m , I_b , I_{c2} vs. E_{c1} (/tubes/C1)):** At a plate voltage of 250 V and screen voltage of 100 V, the transconductance (g_m) decreases smoothly as the control grid voltage is made more negative. Rather than cutting off abruptly, the plate and screen currents taper off gradually, allowing the tube to handle large input signals without clipping or generating excessive cross-modulation when biased near cutoff by an AVC circuit.
- **Characteristics vs. Screen Voltage (g_m , I_b , I_{c2} , r_p vs. E_{c2}):** With a constant plate voltage of 250 V and control grid bias of -3 V, increasing the screen voltage from 25 V to 150 V results in a linear increase in transconductance and plate current, while the plate resistance (r_p) drops from approximately 2.5 Megohms down to less than 0.5 Megohm.

Related Designations and Comparisons

The **12SK7**, **12SK7GT**, and **12SK7GT/G** share identical electrical characteristics and ratings, differing only in their physical construction (metal shell versus glass bulb) and slight variations in interelectrode capacitances.

The 12SK7 family is electrically identical to the [6SK7](#) and [6SK7GT](#) series, with the sole exception of the heater requirements. The [6SK7](#) series operates on a **6.3 V, 0.3 A** heater supply, whereas the 12SK7 series is designed for a **12.6 V, 0.15 A** supply. This makes the 12SK7 family highly suitable for series-string heater arrangements or 12-volt electrical systems.

Within the 12-volt octal lineup, the 12SK7 serves as the remote-cutoff RF pentode, complementing other specialized types such as the [12SJ7](#) (a sharp-cutoff RF pentode) and the [12SQ7](#) (a double diode triode). While these tubes share similar physical dimensions and octal bases, their internal structures and electrical characteristics are distinct, and they cannot be directly substituted for one another without circuit modification.

Technical Summary

The **12SK7** is an octal-based, indirectly heated remote-cutoff RF pentode. It features a **12.6 V, 0.15 A** heater, a coated unipotential cathode, and a triple-grid structure designed to minimize cross-modulation and facilitate automatic volume control in RF and IF amplifier stages.

At its standard operating point of 250 V on the plate and 100 V on the screen, the tube provides a transconductance of **2,000 μ mhos** and a plate resistance of **0.8 Megohm**, with plate and screen currents of **9.2 mA** and **2.4 to 2.6 mA**, respectively. Its remote-cutoff characteristic allows the transconductance to be reduced smoothly to 10 μ mhos at a control grid bias of -35 V. Available in both metal (12SK7) and glass ([12SK7GT](#), [12SK7GT/G](#)) envelopes, this versatile pentode remains a standard reference for variable-gain voltage amplification in classic receiver designs.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1948 Brimar Radio Valve Manual

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1948 BRIMAR RADIO VALVE MANUAL

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage	250 V	—
Anode Current	9.2 mA	—
Screen Voltage	100 V	—
Screen Current	2.4 mA	—
Control Grid Voltage	-3 V	—
Cathode Bias Resistor	220 ohm	—
Control Grid Voltage for Low Transconductance	-35 V	Transconductance=0.01mA/V



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X General Electric Essential Characteristics

Published test conditions and operating points. Values on this page are preserved as reported by this source.

195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	6 pF	Section1
Output capacitance	7 pF	Section1
Grid-to-plate capacitance	0.003 pF	Section1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA
Screen voltage	100 V	ClassA
Control-grid voltage	-3 V	ClassA
Plate current	9.2 mA	ClassA
Screen current	2.6 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	800000 Ω	Section1
Transconductance	2000 μS	Section1



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

1966 Tung Sol Electronic Tubes 2 of 4

SOURCE PDF

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID TO PLATE	0.003 pF	Interelectrode capacitances; published column 1
GRID TO PLATE	0.005 pF	Interelectrode capacitances; published column 2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	6.3 V	Maximum ratings
MAXIMUM HEATER CATHODE VOLTAGE	90 V	Maximum ratings
MAXIMUM PLATE VOLTAGE	300 V	Maximum ratings
MAXIMUM GRID #2 SUPPLY VOLTAGE	300 V	Maximum ratings

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM POSITIVE	0 V	Maximum ratings; published column 1
MAX EMUM PLATE DISSIPATION	4 W	Maximum ratings; published column 1
MAX EMUM PLATE DISSIPATION	0 W	Maximum ratings; published column 2
MAXIMUM GRID #2 DISSIPATION	0 W	Maximum ratings; published column 1
MAXIMUM GRID #2 DISSIPATION	11 W	Maximum ratings; published column 2
HEATER VOLTAGE	6 V	Typical operating conditions; published column 1
HEATER CURRENT	0 mA	Typical operating conditions; published column 1
PLATE VOLTAGE	100 V	Typical operating conditions; published column 1
PLATE VOLTAGE	25 V	Typical operating conditions; published column 2
PLATE VOLTAGE	0 V	Typical operating conditions; published column 3
PLATE CURRENT jj	9.2 mA	Typical operating conditions
GRID #2 CURRENT	11 mA	Typical operating conditions; published column 1
GRID #2 CURRENT	2 mA	Typical operating conditions; published column 2
PLATE RESISTANCE (APPRO%.)	12000000 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE (APPRO%.)	0 ohm	Typical operating conditions; published column 2
GRID #i VOLTAGE (APPRO%.) FOR Gm	10 uS	Typical operating conditions; published column 1
GRID #i VOLTAGE (APPRO%.) FOR Gm	-35 uS	Typical operating conditions; published column 2
Ef =	6.3 V	Typical operating conditions
EcZ =	100 V	Typical operating conditions
Eci '	0 V	Typical operating conditions; published column 1
PLATE CURRENT (	1 mA	Typical operating conditions; published column 1
PLATE CURRENT (	0 mA	Typical operating conditions; published column 2
Eq =	6.3 V	Typical operating conditions

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
E _b =	250 V	Typical operating conditions
EC1	0 V	Typical operating conditions
E _f =	2.5 V	Typical operating conditions; published column 2
E _{~i}	-3 V	Typical operating conditions
E _{o3}	0 V	Typical operating conditions; published column 1
EC3	0 V	Typical operating conditions
Maximum plate voltage	300 V	Published datasheet; promoted section value
Maximum plate dissipation	4 W	Published datasheet; promoted section value
Maximum screen dissipation	0.11 W	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	800000 ohm	Published datasheet; promoted section value
Transconductance	0.002 A/V	Published datasheet; promoted section value

TUBE TINKER

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